STEO

A Systems Framework for Behavioural Self-Development

An interdisciplinary conceptual model integrating systems theory, behavioural science and artificial intelligence

Tatiana Satcau | Andrei Satcau

STEO Research Initiative, Melbourne, Australia

CONCEPTUAL ARTICLE

Prepared for academic review and peer-reviewed submission

Abstract

Human behaviour is often examined through separate biological, cognitive, emotional and environmental variables, despite the fact that these processes interact continuously. This article presents the STEO Framework, an interdisciplinary conceptual model that treats behavioural self-development as a recursive systems process. Drawing on systems theory, cybernetics, complexity science, self-regulation research and reflective practice, the framework describes behaviour through the sequence Impulse -> State -> Interpretation -> Choice -> Action -> Outcome -> New State. The output of one cycle becomes part of the conditions of the next, allowing adaptive and maladaptive patterns to become self-reinforcing over time. The framework proposes that internal state is an active component of interpretation and that structured backward reflection can help make otherwise automatic feedback structures visible. Human functioning is further situated within nested biological, psychological, behavioural, interpersonal and environmental systems. Artificial intelligence is positioned as a reflective support technology capable of organising longitudinal information and identifying recurring relationships, while judgement and agency remain with the individual. The article defines the framework's conceptual scope, distinguishes it from a clinical or diagnostic model and outlines a programme of empirical research. The proposed contribution is a systems architecture for structured behavioural self-reflection that connects established theoretical traditions with practical and digital implementation.

Keywords: systems theory; behavioural self-development; feedback loops; self-reflection; self-regulation; artificial intelligence; complexity science

1. Introduction

Human behaviour emerges from interactions among biological conditions, cognitive processes, emotional states, social relationships and environmental demands. Nevertheless, many approaches to behaviour change isolate one component of this system: a belief, a habit, an intention, a reinforcement schedule or a measurable outcome. Such approaches can be useful, but they may provide only a partial account of why patterns persist, why the same intervention produces different results across people and why changes in one area of life alter functioning elsewhere.

Systems theory offers a different starting point. Rather than treating behaviour as the product of a single cause, it directs attention to relationships, feedback, context and change over time. The relevant unit of analysis is not an isolated event but an interacting configuration in which outputs become future inputs. Cybernetics adds the study of regulation and feedback; complexity science explains how organised patterns can emerge from local interactions; and self-regulation research examines how people monitor and adjust behaviour in relation to goals. These traditions provide complementary insights, yet they are not always presented within a practical architecture that individuals can use to observe their own recurring behavioural processes.

The STEO Framework was developed to address this integrative gap. It proposes that behavioural self-development can be understood through a recursive sequence: Impulse, State, Interpretation, Choice, Action, Outcome and New State. The sequence is not presented as a complete causal theory of human behaviour. It is a conceptual map designed to make relationships among context, internal condition, meaning-making, agency and feedback easier to examine.

The central claim is that many repeated behaviours are maintained by feedback structures rather than by isolated choices. An outcome modifies the individual's internal and external conditions, which then influence the next cycle. Over time, beliefs, states, routines and environments may mutually reinforce one another. Structured reflection can therefore focus not only on what a person did, but on the upstream conditions that made a response more probable.

The framework also considers the role of artificial intelligence in reflective practice. Digital systems can organise repeated observations across time and detect relationships that may be difficult to recognise through memory alone. Within STEO, however, AI is not positioned as an authority that decides how a person should live. Its appropriate role is to support visibility, questioning and pattern recognition while preserving human judgement and responsibility.

This article has four aims. First, it establishes the theoretical foundations of the framework in systems theory, cybernetics, complexity science and self-regulation. Second, it defines the STEO Loop and the concepts of state-dependent interpretation and self-reinforcing behavioural patterns. Third, it considers applications in behavioural self-development, digital technology and interdisciplinary research. Finally, it defines the scope of the model and proposes directions for empirical investigation.

2. Theoretical Foundations

2.1 Systems Theory and Human Behaviour

General systems theory challenged explanations that reduce complex phenomena to isolated components. Von Bertalanffy (1968) argued that systems are defined not only by their parts but by the organisation and relationships among them. In behavioural contexts, this implies that cognition, emotion, physiology, action and environment should not automatically be treated as independent causes. Their effects depend on the configuration in which they operate.

A systems perspective also emphasises open exchange. Human beings continuously receive information, energy and material inputs from their environments and alter those environments through action. Sleep, stress, relationships, technology, work conditions and physical health are not peripheral influences on behaviour; they are components of the behavioural system. A change in one component may therefore produce non-linear consequences elsewhere.

This view is compatible with ecological approaches to development, which locate the individual within interacting interpersonal, institutional and cultural contexts (Bronfenbrenner, 1979). It is also consistent with biopsychosocial thinking, which rejects a strict separation among biological, psychological and social determinants of health and behaviour (Engel, 1977). STEO builds on these traditions by using systems language to organise a practical model of recurrent behavioural processes.

2.2 Cybernetics and Feedback Processes

Cybernetics concerns communication, control and regulation in animals and machines (Wiener, 1948). Its central insight is that systems adjust through feedback. Negative feedback can stabilise a system around a reference condition, while positive feedback can amplify deviation and accelerate change. In human behaviour, both forms are visible: corrective feedback may help restore a goal-directed pattern, whereas self-reinforcing loops may intensify avoidance, conflict, confidence or practice.

Carver and Scheier's control theory of self-regulation describes behaviour as a process in which perceived conditions are compared with reference values and discrepancies guide action (Carver & Scheier, 1982). Yet the meaning assigned to a discrepancy is not fixed. The same gap may be interpreted as motivating, threatening or impossible depending on current state and prior learning. This interpretative layer is central to the STEO model.

Feedback also introduces temporal recursion. The consequences of an action alter future conditions, which influence subsequent perception and response. A behavioural outcome is therefore both an endpoint and a new input. This recursive principle provides the structural basis of the STEO Loop.

2.3 Complexity Science and Adaptive Behaviour

Complex systems consist of multiple interacting components whose collective behaviour cannot always be predicted from any component alone. They display emergence, adaptation, sensitivity

to initial conditions and transitions between relatively stable patterns (Holland, 1995; Mitchell, 2009). Human behaviour has similar characteristics. Small changes in sleep, stress, social feedback or perceived safety may have negligible effects in one context and substantial effects in another.

Complexity science therefore cautions against assuming proportional relationships between intervention and outcome. A minor intervention may become a leverage point when it alters a reinforcing loop, while an intensive intervention may have little lasting effect when the wider system restores its previous organisation. The concept of attractors is particularly relevant: repeated behavioural and emotional configurations may become relatively stable states toward which the system tends to return.

The STEO Framework does not claim that psychological patterns are mathematically equivalent to formal dynamical attractors. It uses the analogy cautiously to highlight stability, recurrence and the possibility of transition. The model directs attention to how multiple small influences combine to maintain a pattern and to where a change may propagate through the wider system.

2.4 Self-Regulation and Reflective Awareness

Self-regulation involves monitoring, evaluating and adjusting behaviour in relation to goals and standards. Contemporary accounts emphasise that regulation depends on attention, motivation, emotion, beliefs about control and environmental support. Metacognition adds awareness of one's own cognitive processes, while reflective practice provides structured methods for examining experience.

Reflection alone does not guarantee change. It may become repetitive, self-critical or disconnected from action. Its value depends partly on structure. By separating impulse, state, interpretation, choice, action and outcome, the STEO Loop provides a sequence through which reflection can move beyond description toward process analysis.

The framework is also compatible with research on psychological flexibility, which concerns the capacity to respond adaptively to changing circumstances rather than being governed rigidly by internal experiences (Kashdan & Rottenberg, 2010). STEO does not reproduce any single therapeutic model. It offers a systems architecture within which flexibility, metacognition and self-regulation can be examined together.

2.5 Research Gap

Existing theories explain many components of behaviour, including reinforcement, cognition, self-efficacy, goal regulation, affect and environmental context. The gap addressed here is not an absence of behavioural theory. It is the absence of a concise, interdisciplinary process architecture that links internal state, interpretation, choice and feedback in a form suitable for structured self-reflection and digital implementation.

The STEO Framework responds to this gap by integrating established principles without claiming to replace the theories from which they are drawn. Its scientific value should therefore be

assessed by conceptual clarity, generative capacity and future empirical usefulness rather than by novelty of every individual component.

3. The STEO Framework

3.1 Overview

The STEO Framework conceptualises behavioural self-development as the increasing capacity to perceive and interact deliberately with the systems that generate recurring outcomes. Behaviour is treated as a dynamic product of biological, cognitive, emotional, interpersonal and environmental processes linked through feedback.

The framework integrates three dimensions. First, behaviour is represented as a recursive feedback process. Second, individuals are situated within nested systems that influence one another across levels. Third, digital technologies, including artificial intelligence, may support observation of patterns across time without replacing human agency.

The framework is descriptive and reflective rather than diagnostic. It does not assign pathology, establish clinical thresholds or prescribe a universal sequence of intervention. Its purpose is to organise inquiry: what entered the system, what state followed, how the event was interpreted, what options appeared available, what action occurred and how the outcome shaped the next state.

3.2 The STEO Loop

The central mechanism is represented as follows:

Figure 1. The STEO Loop.

Impulse. An impulse is any internal or external event capable of influencing the system. It may be sensory, emotional, physiological, social, informational or environmental. The event does not determine the response by itself; its effect depends on the condition of the system receiving it.

State. State refers to the immediate physiological, emotional and cognitive organisation of the individual. Fatigue, arousal, stress, perceived safety, pain, confidence and prior activation can alter attention and response readiness.

Interpretation. Interpretation is the meaning assigned to the impulse. It is shaped by memory, beliefs, expectations, schemas, context and current state. The same event may therefore be experienced as threat, rejection, opportunity, ambiguity or irrelevance.

Choice. Choice refers to the responses perceived as available. The term does not imply that all behaviour is fully conscious or unconstrained. Automatic learning, social conditions and intense states may substantially narrow the experienced range of options.

Action. Action is the behavioural expression of the selected response. It may be observable or internal, deliberate or habitual, immediate or delayed.

Outcome. Outcome refers to the consequence of the action for the individual, other people and the surrounding environment. Outcomes include both intended and unintended effects.

New State. The outcome modifies internal and external conditions. This new state becomes part of the context in which the next impulse is received, completing the recursive loop.

3.3 Nested Systems Model

The loop operates within multiple interacting systems. Biological regulation shapes emotion and cognition; psychological processes influence behaviour; behaviour alters relationships and environments; social conditions feed back into biological and psychological states. No level operates independently.

The nested systems model used here includes biological, psychological, behavioural, interpersonal and environmental or social levels. These are analytical distinctions rather than sealed categories. Their boundaries are permeable, and causal influence can move in multiple directions.

Figure 2. Interacting levels in the nested systems model.

A systems formulation changes the question asked about a behavioural difficulty. Rather than assuming that the problem is located solely within the person, it examines relationships among state, learning history, social context, environmental cues and reinforcing consequences. It also

allows change in one part of the system to be understood as a possible source of secondary effects elsewhere.

The seven life domains used in the STEO application - Health, Sex, Money, Love, Power, Purpose and Happiness - are an implementation-layer structure for organising reflection. They are not theoretical components of the systems framework and are therefore not developed as a separate conceptual model in this article.

3.4 The STEO Loop as a Reflective Intervention

The STEO Loop is intended not only as a description of behavioural process but as a structure for reflection. Its practical use begins with an observed outcome and traces the sequence backwards: What action contributed to the outcome? What choice preceded the action? What interpretation made that choice appear appropriate? What state influenced the interpretation? What impulse initiated the sequence?

Backward tracing is designed to identify leverage points. Individuals may have limited influence over the initiating event, but greater influence over recurring inputs, state regulation, interpretation and environmental design. The model therefore directs attention upstream rather than treating the visible behaviour as the only point of intervention.

The process is not intended to imply that all outcomes are individually controlled. Biological limitations, coercive relationships, economic conditions, discrimination and institutional structures can constrain choice substantially. A systems analysis should make those constraints more visible, not translate them into personal blame.

Repeated use of the sequence may improve the timing and precision of self-observation. Instead of recognising a pattern only after an unwanted outcome, a person may learn to recognise the state or interpretation that commonly precedes it. This proposed mechanism remains open to empirical testing.

3.5 State-Dependent Interpretation

A central assumption of the framework is that interpretation is state-dependent. People do not process information from a neutral baseline. Stress, fatigue, mood, arousal, pain, perceived safety and cognitive load alter attention, salience and behavioural readiness. An ambiguous interaction may appear manageable in one state and threatening in another.

State is therefore treated as an active component of the behavioural system rather than a background variable. This does not reduce behaviour to physiology. State includes biological, emotional and cognitive dimensions and is itself shaped by interpersonal and environmental conditions.

The practical implication is that some difficulties attributed to motivation or character may be better understood as recurrent state-pattern relationships. For example, avoidance may arise when depletion increases threat sensitivity, threat sensitivity produces a negative interpretation

and that interpretation narrows perceived options. Intervention may then require changes to state or context in addition to intention.

3.6 Patterns as Self-Reinforcing Feedback Structures

The STEO Framework defines a behavioural pattern as a recurring feedback structure rather than a repeated action alone. A pattern includes the impulses, states, interpretations, responses and consequences that make recurrence more likely.

Self-reinforcing loops may produce maladaptive or adaptive outcomes. A person who expects rejection may interpret ambiguity as distancing, respond defensively and generate tension that appears to confirm the original expectation. Conversely, practice can increase competence, competence can increase confidence and confidence can increase willingness to continue practising.

The persistence of a pattern therefore does not necessarily indicate that any single belief is accurate or that any single action is the sole cause. The wider loop may repeatedly generate evidence that stabilises the existing organisation. Sustainable change may require intervention at the level of state, interpretation, environmental input or reinforcement rather than at the behavioural endpoint alone.

4. Applications of the STEO Framework

The value of a conceptual framework lies in its capacity to organise inquiry and guide responsible application. STEO is proposed as a general systems model rather than a protocol for one discipline. Its potential relevance extends across behavioural self-development, education, organisational learning, preventive wellbeing, digital health and human-centred artificial intelligence.

4.1 Behavioural Self-Development

Many self-development approaches focus on isolated goals such as discipline, confidence, productivity or habit formation. The STEO Framework redirects attention from the desired endpoint to the system repeatedly producing the current outcome. The practical task is not only to decide what should change but to identify the loop through which current conditions are maintained.

Within this model, development involves improved systems literacy: the capacity to recognise feedback, context, state and interdependence. Progress may therefore include earlier recognition of a pattern, more flexible interpretation, greater awareness of constraints and improved ability to create conditions that support adaptive action.

4.2 Digital Behavioural Technologies

Digital technologies can support repeated observation across time. Applications may prompt reflection, record contextual variables, visualise trends and help users compare present

experiences with earlier patterns. This longitudinal function is significant because human memory is selective and current state can distort recall.

Artificial intelligence may add pattern-recognition and adaptive questioning. For example, a system could identify that a recurring action tends to follow particular states or environmental conditions and invite the user to examine the relationship. Such outputs should be framed as hypotheses for reflection rather than objective conclusions about the person.

The framework therefore positions AI as a reflective support technology. Appropriate implementation requires privacy, transparency, explainability, user control and clear boundaries between wellbeing support and clinical care. Decisions remain with the individual, and high-risk situations require qualified professional support rather than automated interpretation.

4.3 Research Applications

The framework provides a shared vocabulary for interdisciplinary research. Components of the loop can be operationalised independently: state can be assessed through self-report or physiological indicators; interpretation can be examined through appraisal measures; choice can be studied through perceived option sets; and outcomes can be tracked behaviourally or subjectively.

The model also supports longitudinal designs that examine within-person variation. Rather than asking only why different people behave differently, researchers can examine why the same person responds differently across states and contexts. This is consistent with a systems view in which behaviour emerges from configurations rather than fixed traits alone.

4.4 Relationship to Existing Behavioural Models

The STEO Framework is intended to complement existing theories. Cognitive models explain appraisal and belief; behavioural theories explain learning and reinforcement; self-regulation theories explain monitoring and goal-directed adjustment; ecological and systems models explain context and interdependence.

STEO's contribution is integrative. It connects these mechanisms within a recursive process architecture suitable for structured reflection and digital implementation. It should therefore be evaluated as a conceptual synthesis and research-generating model, not as a claim that established theories are unnecessary.

5. Discussion

The STEO Framework responds to a persistent challenge in behavioural science: explanatory knowledge is distributed across disciplines, while lived behavioural patterns occur through their interaction. The framework offers a common architecture in which biological state, appraisal, choice, action and feedback can be considered together.

Its principal proposition is that behavioural change is often an emergent property of interacting systems rather than the direct consequence of an isolated variable. Motivation, cognition and

reinforcement remain important, but their influence depends on state, context and reciprocal feedback. This perspective helps explain why the same strategy may succeed in one condition and fail in another.

The model also shifts attention from outcomes to generative process. When an unwanted behaviour is examined only at the point of action, intervention may rely heavily on willpower or suppression. By tracing the sequence upstream, the framework identifies alternative leverage points: recurring impulses, physiological conditions, interpretative habits, environmental design and perceived options.

Structured reflection is central to this contribution. Reflection is often encouraged in self-development, education and therapy, but it is not always operationalised as a process analysis. The STEO Loop supplies a repeatable structure that can be taught, observed and potentially measured. Its value will depend on whether users can apply it accurately and whether doing so produces effects beyond unstructured reflection.

The framework's treatment of AI is deliberately human-centred. Current digital systems are increasingly capable of prediction and recommendation, but behavioural support raises questions of agency, privacy and epistemic authority. STEO proposes that AI should make patterns more visible rather than determine the meaning of a person's experience. This role aligns technological capability with reflective autonomy.

A further contribution lies in linking systems theory with behavioural practice. Systems concepts have long influenced psychology, family therapy, organisational learning and public health, yet they can remain abstract for individual users. The STEO Loop translates recursion and feedback into a sequence that can be applied to everyday experience without reducing the person to a machine.

The model should not be interpreted as a comprehensive account of human behaviour. No seven-stage sequence can represent all unconscious, social, developmental and neurobiological processes. Its purpose is functional: to provide enough structure to support inquiry while remaining flexible enough to accommodate complexity.

The scientific contribution of STEO will ultimately depend on generativity. A useful conceptual framework should clarify questions, enable operational definitions and support falsifiable research. The framework therefore represents the beginning of a research programme rather than a completed evidence claim.

6. Scope of the Present Framework

The STEO Framework is presented as an interdisciplinary conceptual model integrating established principles from systems theory, behavioural science, cybernetics and artificial intelligence into a coherent architecture for structured behavioural self-reflection.

The purpose of the present article is not to evaluate the effectiveness of a particular intervention or technology. It is to define a theoretical structure through which existing knowledge may be organised and future empirical investigation may be guided.

Accordingly, the framework should be understood as a systems architecture rather than a clinical protocol or diagnostic model. It is intended to provide a common conceptual language capable of supporting interdisciplinary collaboration across psychology, systems science, education, digital health and artificial intelligence.

The model is sufficiently general to accommodate multiple forms of implementation. One current implementation is represented through the STEO digital platform, but the underlying framework is independent of any specific application and may be adapted for research, education, coaching, organisational learning or preventive wellbeing contexts.

As with other conceptual models, the framework's long-term scientific value will depend on theoretical critique, empirical investigation and practical refinement. The present article establishes a foundation for that work.

7. Future Research

The STEO Framework is intended to support an interdisciplinary research programme rather than a single definitive test. Its components can be examined independently and in combination across behavioural science, psychology, systems research and digital health.

A first priority is evaluation of the STEO Loop as a structured method of self-reflection. Randomised studies could compare it with unstructured journaling, standard self-monitoring or active control conditions. Outcomes might include metacognitive awareness, psychological flexibility, perceived behavioural control, goal consistency and recognition of recurring triggers.

A second direction concerns state-dependent interpretation. Experience-sampling methods could examine whether within-person changes in fatigue, stress, perceived safety or arousal predict changes in appraisal and subsequent behaviour. Such studies would test the proposed relationship between state and the range of choices perceived as available.

Longitudinal designs are particularly important because the framework describes development as iterative. Research could investigate whether repeated use leads to earlier recognition of patterns, more accurate anticipation of high-risk states or improved selection of upstream interventions. Sequence analysis may help identify common loop configurations across individuals while preserving person-specific variation.

Artificial intelligence creates another area for investigation. Comparative studies could examine whether AI-supported pattern summaries or adaptive questions improve the depth and consistency of reflection beyond conventional digital journaling. Evaluation should include not only behavioural outcomes but also trust, autonomy, privacy perceptions, error effects and the risk of over-reliance on algorithmic interpretations.

Cross-cultural research is also required. Interpretations of agency, power, emotion, intimacy and wellbeing differ across social contexts. The broad architecture may be transferable, but prompts, examples and implementation should not assume that behavioural meanings are universal.

Finally, research should compare the framework with established models of behaviour change and self-regulation. The objective is not to demonstrate superiority in every context, but to determine whether the systems architecture adds explanatory or practical value, for whom and under what conditions.

8. Conclusion

This article has presented the STEO Framework as an interdisciplinary systems architecture for behavioural self-development. It integrates systems theory, cybernetics, complexity science, self-regulation and reflective practice through the sequence Impulse -> State -> Interpretation -> Choice -> Action -> Outcome -> New State.

The framework proposes that behaviour is produced through continuous interaction among internal condition, meaning-making, agency, action and feedback. Outcomes are not isolated endpoints; they alter the conditions of future behaviour. Recurrent patterns can therefore be understood as self-reinforcing structures distributed across biological, psychological, interpersonal and environmental systems.

The practical contribution of the model is structured backward reflection. By tracing an outcome through action, choice, interpretation, state and impulse, individuals and researchers may identify leverage points that remain hidden when attention is directed only toward the final behaviour.

Artificial intelligence may support this process by organising longitudinal observations and identifying recurring relationships. Within the framework, however, AI remains a reflective support technology rather than a substitute for human judgement, responsibility or qualified care.

The STEO Framework is offered as a conceptual structure for inquiry, discussion and empirical investigation. Its central proposition is that awareness changes the role a person occupies within a feedback loop. A pattern that remains unseen is more likely to repeat automatically; a pattern that becomes visible can be examined, questioned and, under appropriate conditions, changed.

References

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Prentice-Hall.

Bronfenbrenner, U. (1979). The ecology of human development. Harvard University Press.

Carver, C. S., & Scheier, M. F. (1982). Control theory: A useful conceptual framework for personality-social, clinical, and health psychology. Psychological Bulletin, 92(1), 111-135.

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. Science, 196(4286), 129-136.

Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Addison-Wesley.

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. Clinical Psychology Review, 30(7), 865-878.

Meadows, D. H. (2008). Thinking in systems: A primer. Chelsea Green Publishing.

Mitchell, M. (2009). Complexity: A guided tour. Oxford University Press.

Morin, E. (2008). On complexity. Hampton Press.

Schön, D. A. (1983). The reflective practitioner: How professionals think in action. Basic Books.

Varela, F. J., Thompson, E., & Rosch, E. (1991). The embodied mind: Cognitive science and human experience. MIT Press.

von Bertalanffy, L. (1968). General system theory: Foundations, development, applications. George Braziller.

Wiener, N. (1948). Cybernetics: Or control and communication in the animal and the machine. MIT Press.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), Handbook of self-regulation (pp. 13-39). Academic Press.